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(54) VERTICAL CURRENT SEPARATION OF PRECONDITIONED GARBAGE FROM HEAVIER FRACTIONS AND LIGHTER CLINKERLESS COMBUSTIBLES

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ABSTRACT OF THE DISCLOSURE

A closed system between a conveyor-pressure operated intake port at an air sealed gate overlying a hopper for receiving and funneling preconditioned garbage into the restricted end of a tapering air duct through which air from a blower enters to effect venturi action forcing the garbage toward the lower end of a vertical stack of zigzag ducts wherein heavier fractions drop out to be used as earth fill and the like while lighter fractions discharge into a trommel screen in a closed chambered storage bin for future use as a fuel, such as combustible briquettes and the like, from which closed chambered storage bin air recirculates back to the blower from which supplemental air feeds into an air cushion at the juncture of the tapering air duct with the stack of ducts for boosting the on coming garbage up into the latter, and means for controlling air pressure within the ducts of the system.

BACKGROUND

This inv ntion relates to garbage disposal systems and to apparatus in such systems for processing raw garbage preparatory to ultimate disposal. The invention is particularly directed to a classifier in such systems for separating heavier elements, especially of the noncombustible type, from lighter fractions in garbage which are more easily disposed of by combustion or conducive to formation into usable and saleable articles.

The overall combination of devices and components for processing raw garbage are well known in the art. For example, reference to United States Patent No. 3,473,494 issued on October 21, 1969, to GIANNI SIRACUSA and United States Patent No. 3,584,587 issued on June 15, 1971, to GIANNI SIRACUSA may be had for an understanding of the usual procedure. In such prior type systems, the raw garbage is first loosened up by passage through a beater for breaking it up into a more friable condition for separation. In this condition, any heavier ferrous metal therein is magnetically detected, withdrawn, and discharged therefrom at a ferrous metal discharge station. The remaining nonferrous portion is then passed through a grinder for crumbling into smaller segments which are then shredded and passed through a dryer. Heretofore, it was believed that the product at this stage could be disposed of by combustion within a furnace by which all of the remaining material could be consumed. This resulted in a biproduct of slag or cinders mainly consisting of glass and some of the plastics which remained in the product. The greatest difficulty arose from the formation of solid clinkers in the base of the furnace requiring periodic shut-down to enable workmen to remove

such clinkers. Such removal usually requires a hammer and pick and more often than not the base or sump of the furnace became damaged requiring extensive and costly repairs.

It later became apparent that such slag might be kept molten within the furnace and discharged therefrom in a molten condition. This requires a heat of greater intensity at the sump level of the furnace. The intensive heat required rendered the lining of the furnace frangible and subject to damaging effects within short periods of time.

THE PRESENT INVENTION

The present invention, subjects the shredded and dried material, free of ferrous metals to further separation by a classifier. By this, the heavier shredded particles of non-ferrous metal, glass or silicate grit as well as plastic are separated from lighter particles of paper, vegetation, meat scraps, and pulp. Such lighter particles in a fluffed condition are then subjected to screening in a trommel screen so as to sift out any fine dust or grit, silicate and the like. The remaining fluffed material is then more conducive to being completely consumed by combustion.

The remaining lighter screened fluffed material can be stored in a storage bin preparatory to disposal by either combustion within a furnace; or for suitable treatment with a bonding agent whereby the material may be compacted into various forms of usable articles. This may entail the molding of the treated material into slabs or blocks of building materials or into cakes and/or pellets by compression for use in fire places, barbeque pits and the like for heating purposes.

An air classifier can be provided within a closed system including an air return for recirculating the air from the storage bin back into the blower of the system. Also a venturi arrangement can be provided at the point of admittance of the shredded dried remaining refuse so as to quickly remove the latter discharging into the main air intake duct of the system.

Thus in accordance with the present invention there is provided an apparatus for disposing of refuse such as garbage and the like from which heavier ferrous material has been removed and the remaining refuse ground up, shredded and dried as a preconditional material; a closed air system for separating heavier, noncombustible elements in such material from lighter fractions therein preliminary to consumption of the latter by fire or conversion into useful products comprising: a feed conveyor for feeding such preconditioned material to the closed air system; a hopper for receiving such preconditioned material from said feed conveyor; an air sealed gate at the open upper end of said hopper openable by discharge of such preconditioned material from said feed conveyor into said hopper; an elongated tapering infeed duct having a restricted open end communicating with the lower end of said hopper for receiving such preconditioned material therefrom and declining at a slight angle relative to horizontal from said restricted open end and expanding in area progressively therefrom toward a terminal end; a stack of vertically disposed zigzag ducts having its lower end communicating with the terminal end of said elongated tapering infeed duct and providing a tortuous path discharging at its upper end; a closed chambered storage bin communicating with the discharge upper end of said stack of zigzag ducts; a blower, having a housing communicated with the restricted open end of

said tapering infeed duct for creating a venturi action at the lower end of said hopper for transmitting such preconditioned material therefrom and for causing the incoming shredded, dried material to spread out and flow more loosely and openly through the gradually expanding elongated tapering infeed duct and into said stack of zigzag ducts for discharging lighter fractions from the latter into said storage bin; an air return duct between said closed chambered storage bin and said blower for recirculating air from the bin to the blower; a baffle wall projecting upwardly from the declining bottom wall of said elongated tapering infeed duct at the open lower end thereof for providing a trough-like terminal end therein; a perforated plate mounted in the trough-like terminal end of said infeed duct and extending tangentially from the bottom wall thereof toward the upper edge of said baffle wall for providing an air lift chamber therebetween; and a supplemental air supply duct communicating said blower with said air lift chamber for supplying air through the perforated plate to create an air cushion for lifting preconditioned material therefrom and into the air stream passing from said infeed duct into the lowermost one of said zigzag ducts in the stack thereof.

These and other advantages of the present invention will become apparent in the following description when read in the light of the accompanying five sheets of drawings in which:

Fig. 1 is a diagrammatic plan view of the initial treatment and handling of garbage and the like preliminary to its admittance into the classifier embodied in the present invention;

Fig. 2 is a foreshortened plan view of the main duct infeed to the classifier;

Fig. 3 is a diagrammatic plan view of the balance of the garbage treatment and disposal plant embodying and illustrating the closed air recirculating system of the present invention;

Fig. 4 is a cross section through a trommel screen in the holding bin of Fig. 3 and taken substantially along line 4-4 therein;

Fig. 5 is a side elevation of a portion of Figs. 1, 2 and 3 with parts of the holding bin of the latter shown

in section;

Fig. 6 is an enlarged sectional view through the classifier, air intake and velocity control zone of the arrangement shown in Fig. 5;

Fig. 7 is a modified construction of the air intake and velocity control zone of the present invention;

Fig. 8 is an enlarged section through the venturi entrance to the main infeed duct taken substantially along lines 8-8 in each of Figs. 1 and 2;

Fig. 9 is a vertical section through Fig. 8 taken substantially along line 9-9 therein;

Fig. 10 is a horizontal section through Fig. 8 taken substantially along line 10-10 therein;

Fig. 11 is a longitudinal section through an airlift cushion screen at the discharge end of the main infeed air duct of Fig. 2 and taken along line 11-11 therein;

Fig. 12 is a cross section through Fig. 11 taken along line 12-12 therein;

Fig. 13 is a fragmentary diagramatic perspectus view of the air infeed duct and air lift cushion of Fig. 8 and 11 combined.

Fig. 14 is a schematic wiring diagram of the pressure sensor and servo solenoid control for the damper in the closed air system.

GENERAL DESCRIPTION

Referring to Figs. 1, 2, 3, and 5 of the drawings, the entire apparatus generally designated 15 includes a preparation section 16; an air classifier 17 (Fig. 5); trommel screen 18, storage bin 19 and a disposal of the final bi-product for example in a furnace 20 disclosed in the present application.

The pre-preparation section 16 as best illustrated in Fig. 1 includes a conveyor 21 by which the raw garbage is put through a series of devices for transformation into a condition suitable for disposal. The raw garbage is fed into the conveyor 21 (lower end Fig. 1) for movement through a hammer mill 22 to loosen up and separate the congealed refuse into a more flowable condition. Thence the garbage is conveyed through a magnetic field in a device 23 by which the ferrous portion in the garbage is removed and discharged therefrom.

Once the ferrous metals are removed from the garbage, the latter is put through a grinder 24 for chopping up the refuse material into a more friable condition. In this condition, the material is put through a shredder 25 and a dryer 26 for conveyance toward the classifier 17.

The shredded, dried remaining refuse material designated M is conveyed toward the classifier by the conveyor belt 27 having a terminal pulley 28 at its discharge end 29.

DETAILED DESCRIPTION OF THE INVENTION

In accordance with the present invention, the classifier 17 is embodied in a closed system 30 between a hopper 31 at the discharge end 29 of conveyor 27 and the storage bin 19. For this reason, the storage bin 19 is in a closed chamber 32 in which the trommel screen 18 is housed.

The air classifier 17 is of the zigzag type in which a series of alternately pitched angular ducts 33 are arranged as a vertical stack 34 such that there is no direct vertical path therethrough. The refuse material M from the hopper 31 is transmitted via an air admittance and velocity control duct 35 toward a juncture 36 of the lowermost one of the ducts 33 in the stack 34 with a drop-out duct 37.

The duct 35, hereinafter referred to as an infeed duct, is an elongated duct tapering from a restricted smaller end 38 adjacent the hopper 31 to an enlarged open end 39 at the juncture 36 of the duct system. A blower 40 introduces a blast of air into the restricted end 38 of the infeed duct 35 which effects a venturi action V. The venturi action V is such that the material M falling from the hopper 31 is immediately removed therefrom by suction and moved along the gradually enlarging infeed duct toward the enlarged open end 39 thereof.

The flow of air and material M is upwardly the tortuous path in the stack 34 of zigzag ducts 33 for discharge via an arcuate duct 41 the discharge end 42 of which spills downwardly into the trommel screen 18 in the closed chamber 32 of the storage bin 19. By passage of the material M upwardly in the zigzag stack 34 any heavier particles of glass, plastic and the like strike the inclined walls i thereof and fall back down the declined walls d as indicated by the solid arrows O in Fig. 6 of the drawings. The lighter particles of the material M continue upwardly the tortuous path for discharge into one end of the trommel 18 in the bin 19 along the lines of the open arrows S in Fig. 6.

The trommel 18 is best seen in Figs. 3, 4, and 5, is made up of a wire mesh screen 43 within a plurality of channel-shaped rings 44 supported on rollers 44' (Fig. 4). The trommel 18 is caused to rotate by a chain and sprocket drive 45 (Fig. 5) so that the material M tumbles within the screen 43 to sift out particles of grit and sand before the material discharges into the storage bin at the opposite end of the trommel.

The foregoing agitation of the material M in the trommel creates a dust which is carried off from the closed chamber 32 in the bin 19 by the air therein being drawn toward the inlet end 46' of an air return duct 46 the opposite end of which communicates with the air intake side of the blower 40 (Fig. 4, 5 and 7), as a part of the closed system 30.

The closed system 30 is further enhanced by an air lock in the form of a gate 47 at the open upper end of the hopper 31 as best illustrated in Figs. 6, 7 and 8. It will therein be noted that the hopper 31 has a vertical wall 48 opposite the discharge end 29 of the conveyor 27. The side walls 49-49' of the hopper 31 have their vertical upper portions supported between beams 50-50' which support the full width of the conveyor 27. The lower portions of the side walls 49-49' of hopper 31 taper downwardly (Fig. 9 and 10) to the width of the restricted end 38 of the infeed duct 35. The gate 47 (Fig. 8) is a hollow segmental structure pivotally mounted as at 51 across the upper edges of the side walls 49-49' of the hopper. The hollow structured gate 47 has one radially disposed door member 52 normally disposed at an angle downwardly toward the terminal pulley 28 at the discharge end 29 of the conveyor 27. The material M coming off of the conveyor 27 forces the door 52 to open to allow the material to fall by gravity into the hopper and toward the infeed duct 35. Other than the opening of the gate thus afforded, the hollow structured gate 47 closes the upper end of the hopper by having an arcuate wall 53 wiping along an air seal brush or resilient member 54 mounted on the vertical wall 48 of the hopper 31.

The upper radial portion 55 of the gate 47 is an open structure having a flange 56 extending from the upper end

of the arcuate wall 53 so as to bear against the upper edge of the vertical wall 48 of the hopper. This serves as a stop for the gate when in its normally closed condition. The gate 47 may be provided with a weight 57 calculated to cause the gate to close other than against the weight of the incoming material M from the discharge end 29 of the conveyor 27.

In the preferred embodiment of the invention, Figs. 5 and 6, the blower 40 is shown mounted on a blower housing at the floor F of the establishment. In this arrangement, the blower discharges air into an air supply duct 58 disposed at an inclined angle upwardly toward the restricted open end 38 of the infeed duct 35. This arrangement requires a semicircular hook-like terminal end 59 on the air supply duct 58 in order to effect a tangent discharge of air directly into the infeed duct 35. The blower might well be mounted in place of the hook-like terminal end 59 as indicated at 40' in Fig. 7. In either case, the air stream from the blower is converged into the restricted open end 38 of the infeed duct 35 to induce a high pressure velocity venturi action V at the lower end of the hopper 31. A suitable damper D may be embodied in the air supply duct 58 to regulate the velocity of the air flow from the blower. In this connection, it will be noted (Figs. 6, 8 and 13) that the lower end 60 of the vertical wall 48 is curved slightly to funnel the dropping material M into the gradually spreading infeed duct 35.

By the foregoing arrangement, the incoming shredded and dried material M is caused to spread out and flow more loosely and openly into the lowermost duct 33 of the zigzag vertical stack 34 of the air classifier 17. To assure an

air lift action at the juncture 36 of the classifier 17 an air cushion 61 is provided at the enlarged open end 39 of the infeed duct 35 (Figs. 6, 11, 12, and 13).

The air cushion 61 is arranged in a trough-like terminal end 62 of the infeed duct 35 formed by a baffle wall 63 disposed at substantially the same inclination as the inclined wall i of the lowermost one of the zigzag ducts 33 in the stack 34. The baffle plate 63 extends upwardly about one-half the height of the enlarged open end 39 of the infeed duct 35 so as to deflect the air stream upwardly into the stack 34. The air cushion 61 comprises a sieve-like perforated plate 64 having a curved medial wall 65 beginning inwardly the duct 35 and tangentially from the bottom wall 66 thereof up to the top edge of the baffle plate 63. The air cushion 61 also includes diagonally disposed seive-like perforated plates 67 and 67' between each side of the curved medial wall 65 and the respective side walls of the infeed duct 35 as illustrated in Fig. 12. The perforated plates 67 and 67' extend into the infeed duct 35 from an upper edge extending horizontally back from the upper edge of the baffle plate 63. By this arrangement, air chambers 68 and 68' are provided under the diagonally disposed side plates 67 and 67' in communication with a similar air chamber 63' between the baffle plate 63 and the curved medial wall 65 in the trough-like terminal end 62 of the infeed duct 35.

The air cushion 61 is further completed by having air supplied to the chambers 63', 68 and 68' via a supplemental air duct 69 communicated with the main blower 40 of the system. The supplemental air duct 69 has a restricted discharge end 70 communicating with the trough-like terminal

end 62 of the infeed duct 35 to supply air to the chambers 63, 68 and 68' below the perforated plates thereof. The opposite end of the supplemental air duct 69 may be tapped into the main air supply duct 58 as shown in Figs. 5 and 6 or direct to the blower housing as shown at 69' in Fig. 7.

By the foregoing arrangement, air blasting upwardly through the apertures 71 of the seive-like plates 64 at 65, 67 and 67' lifts the oncoming material M and merges with the air carrying the latter through the infeed duct 35. The material M is thereby deflected upwardly into the lowermost zigzag duct 33 of the vertical stack 34 of the classifier 17. This assures ascension of all of the material M into the stack 34 before and removal of any heavier fractions from the infeed duct 35. Such heavier fraction will ultimately meet resistance along any one of the inclined walls i of the zigzag ducts and fall by gravity toward the descending walls d as indicated by the closed arrows in Fig. 6

The heavier fraction of material M falls out of the lowermost duct 33 of the stack 34 between the baffle plate 63 and opposite wall 72 of the duct 33 (Fig. 6) which is parallel to plate 63 at the juncture 36 with the drop out duct 37. The heavier fraction of material M entering the upper end of the drop-out duct 37 may be subjected to air classification by a smaller set of zigzag ducts 73 to assure that any lighter fractions of the material M entering the drop-out duct will be caused to ascend back up into the stack 34 of the classifier 17. To this end the smaller set of zigzag ducts 73 have an air supply from the blower 40 via a secondary duct 74. The secondary duct 74 has communication with the blower via the main air supply duct 58 and

has a terminal end 75 discharging into the lowermost one of the zigzag ducts of the smaller set 73 thereof. The same arrangement is shown in Fig. 7 wherein a modified form of secondary duct 74' extends from the blower 40' to the smaller set of ducts 73 in the drop-out duct 37.

The heavier fraction of the material M ultimately falls from the lower end of the drop-out duct 37 into a flume type conveyor 76 for discharge therefrom. The flume type conveyor 76 also receives sand and grit by way of a chute 77 (Fig. 5) coming from the end of a conveyor belt 78 below the trommel screen 18 in the closed chambered storage bin 19. The fine sand, grit, glass chips and the like heavier fractions discharged from the flume type conveyor 76 may be used in earth fill and the like. The main point involved is that the separation and removal thereof from the lighter fractions of the material M reduces to a minimum the problem heretofore encountered by the formation of slag and/or clinkers in the furnace 20 of a disposal plant.

The lighter fraction of the material M stored in the storage bin 19 may be ultimately consumed by fire in the furnace 20 or may be compressed into slabs or briquets as desired. As shown in Fig. 3 wherein the furnace 20 is illustrated, the material M from the storage bin 19 may be fed automatically therefrom by a screw feed 79. The furnace 20 is shown to have a forced air feed 80 associated with a fluffer 81 such that the stored lighter fraction of the material M will be fluffed up preliminary to entrainment into the forced air feed 80 and into the furnace 20.

SUMMARY 1038335

The preconditioned garbage from which ferrous metals have been removed may contain other metals, glass, grit and plastics in a ground up shredded condition. In accordance with the present invention, such heavier fractions are separated and removed from lighter combustible fractions in the preconditioned garbage. This is accomplished by means of the air classifier 17 disposed between the point of discharge of the feed conveyor 29 and the storage bin 19.

The remaining lighter fraction is thereby reduced to having only a minumum quantity of any heavier fraction therein before passage to a combustion chamber or furnace. Actual experience has shown that for every 1000 pounds of raw garbage treated preliminarily, a good 100 pounds of heavier fraction, exclusive of ferrous metals preliminarily removed, has been separated and collected from the shredded, dry refuse by the air classifier 17 operated in accordance with the present invention.

Reviewing the operation, it is important to note that the air classifier 17 is in a closed system 30. This closed system 30 includes the closed chamber 32 of the storage bin 19 and the air sealed gate 47 on the hopper 31 above the discharge end 29 of the infeed conveyor 27. It also includes the trommel screen 18 and conveyor 78 below it within the closed chamber 32. By the trommel screen, the heavier fractions sifted out of the material M entering the storage bin 19 are removed and discharged via chute 77 into the flume type conveyor 76. Any fine particles of dust within closed chamber 32 are removed therefrom by the negative

pressure afforded at the entrance end 46' of the air return duct 46 going back to the blower 40.

The pneumatic portion of the closed system 30 involves the initial infeed duct 35 and the venturi action V afforded thereby at the restricted open end 38 thereof. The blast of air from the blower 40 is narrowed down to increase its velocity where the refuse material M falls from the conveyor 27. Thus the material is quickly removed toward the enlarged end of the infeed duct 35. It will be noted in Figs. 2, 6 and 13 that the duct 35 expands areawise outwardly and upwardly so that the material carried along by the stream of air spreads out to approximate the width of the ducts 33 in the stack 34 thereof. Moreover, the bottom wall 66 of the duct 35 is set at a downward angle at least 15 degrees off horizontal so that the air stream and material M readily flows toward the juncture 36 between the upper and lower classifier ducts 34 and 73. Then too, the air cushion 61 provided by the perforated plates 64, 67-67' in the trough-like terminal end 62 of the duct 35 and the up draft of air therethrough from the supplemental air duct 69 serves to lift the material M well into the lowermost duct 33 in the stack 34 thereof. In combination with the air cushion structure 61 the baffle wall 63 thereof set at an angle comparable to that of the lowermost duct 33 serves therewith as a receiving end of the zigzag ducts 73 in the drop-out duct 37 below the juncture 36 of the three ducts 35, 33 and 37. This initially isolates the heavier fractions of the material M falling from the lowermost duct 33 in the stack 34 thereof.

It should here be noted that the volume of material carried by the air stream upwardly into the stack 34 may not flow as uniformly as desired. Consequently, the air

pressure required to carry any increase in volume upwardly may have to be increased. This increase in air velocity and pressure is increased by control of the damper D in the main air duct 59.

In order to control the pneumatic pressure in the system 30 automatically pneumatic control sensors may be provided in the zigzag ducts 33 and 73 of the air classifier 17. These sensors, designated 83 may be of any well known pressure gauges for detecting the static pressure within the zigzag ducts to determine the need for a greater of lesser pneumatic pressure therein from the blower 40. In this event, the sensors 83 may be of the electro-mechanical type electrically connected in a circuit 35 having a servo operated solenoid 84 therein. The servo operated solenoid as in United States Patent No. 2,950,424 issued on August 23, 1960, to Traver J. Smith and Ralph K. Daugherty, or United States Patent No. 3,221,170 issued on January 4, 1966, to Traver J. Smith and Ralph K. Daugherty may be operatively connected to the damper D to change or restrict the flow of air. By this arrangement, the velocity of the air flow and pressure within the duct is automatically adjusted to maintain a uniform flow of material through the classifier.

Having thus described the apparatus for reducing preconditioned garbage to a nonclinker producing combustible in specific detail, it will be appreciated by those skilled in the art that such apparatus may be susceptible to variations, alterations and/or modifications without departing from the spirit or scope of the appended claims.

The embodiments of the inv ntion in which an exclusive property or privilege is claimed are defined as follows:

1. Apparatus for disposing of refuse such as garbage and the like from which heavier ferrous material has been removed and the remaining refuse ground up, shredded and dried as a preconditional material; a closed air system for separating heavier, noncombustible elements in such material from lighter fractions therein preliminary to consumption of the latter by fire or conversion into useful products comprising:

(a) a feed conveyor for feeding such preconditioned material to the closed air system;

(b) a hopper for receiving such preconditioned material from said feed conveyor;

(c) an air sealed gate at the open upper end of said hopper openable by discharge of such preconditioned material from said feed conveyor into said hopper;

(d) an elongated tapering infeed duct having a restricted open end communicating with the lower end of said hopper for receiving such preconditioned material therefrom and declining at a slight angle relative to horizontal from said restricted open end and expanding in area progressively therefrom toward a terminal end;

(e) a stack of vertically disposed zigzag ducts having its lower end communicating with the terminal end of said elongated tapering infeed duct and providing a tortuous path discharging at its upper end;

(f) a closed chambered storage bin communicating with the discharge upper end of said stack of zigzag ducts;

(g) a blower, having a housing communicated with the restricted open end of said tapering infeed duct for creating a venturi action at the lower end of said hopper for transmitting such preconditioned material therefrom and for causing the incoming shredded, dried material to spread out and flow more loosely and openly through the gradually expanding elongated tapering infeed duct and into said stack of zigzag ducts for discharging lighter fractions from the latter into said storage bin;

(h) an air return duct between said closed chambered storage bin and said blower for recirculating air from the bin to the blower;

(i) a baffle wall projecting upwardly from the declining bottom wall of said elongated tapering infeed duct at the open lower end thereof for providing a trough-like terminal end therein;

(j) a perforated plate mounted in the trough-like terminal end of said infeed duct and extending tangentially from the bottom wall thereof toward the upper edge of said baffle wall for providing an air lift chamber therebetween; and

(k) a supplemental air supply duct communicating said blower with said air lift chamber for supplying air through the perforated plate to create an air cushion for lifting preconditioned material therefrom and into the air stream passing from said infeed duct into the lowermost one of said zigzag ducts in the stack thereof.

2. A closed system air classifier in accordance with that of Claim 1 including a damper in said supplemental air supply duct for controlling the volume and velocity of air flowing therethrough from said blower into the air lift chamber of said air cushion.

3. The closed system air classifier in accordance with that of Claim 1 in which said baffle wall extends upwardly from the bottom wall of said infeed duct in substantial parallelism relative to the inclined wall of the lowermost one of said zigzag ducts and in spaced relation to such inclined wall to provide a drop-out opening at the lower end of said stack of zigzag ducts for discharging heavier fractions of refuse descending therefrom.

4. The closed system air classifier in accordance with that of Claim 3 including:

(a) a drop-out duct communicating with the drop-out opening at the lower end of said stack; for receiving heavier fractions of refuse material descending therefrom;

(b) a smaller set of zigzag ducts within the drop-out duct for receiving the refuse material descending therethrough; and

(c) a secondary air duct between said blower and the lowermost one of said smaller set of zigzag ducts in said drop-out duct for air lifting any lighter fractions of refuse therefrom back up into said stack of zigzag ducts of the air classifier.

5. A closed system air classifier in accordance with that of Claim 4 including a damper in said secondary air duct for controlling the volume and velocity of air flowing therethrough from said blower into the air lift chamber of said air cushion.

6. The closed system air classifier in accordance with that of Claim 5 including:

(a) a flume type conveyor at the lower end of said drop-out duct for receiving and removing the heavier fractions of refuse therefrom;

(b) a trommel screen in said closed chambered storage bin for receiving the lighter fractions of refuse from the upper end of the stack of zigzag ducts for sifting out any fines of silicate, grit and the like therefrom; and

(c) a conveyor belt below said trommel screen for receiving fines therefrom and for discharging said fines into said flume type conveyor.

7. The closed system air classifier in accordance with that of Claim 6 including:

(a) a damper in the housing of said blower;

(b) a servo operated solenoid operatively connected to said damper; and

(c) a pressure detecting sensor switch means in the zigzag ducts of said stack thereof and electrically connected to said servo operated solenoid for controlling the setting of said damper within the housing of said blower to deliver the required volume of air and velocity thereof to said zigzag ducts.

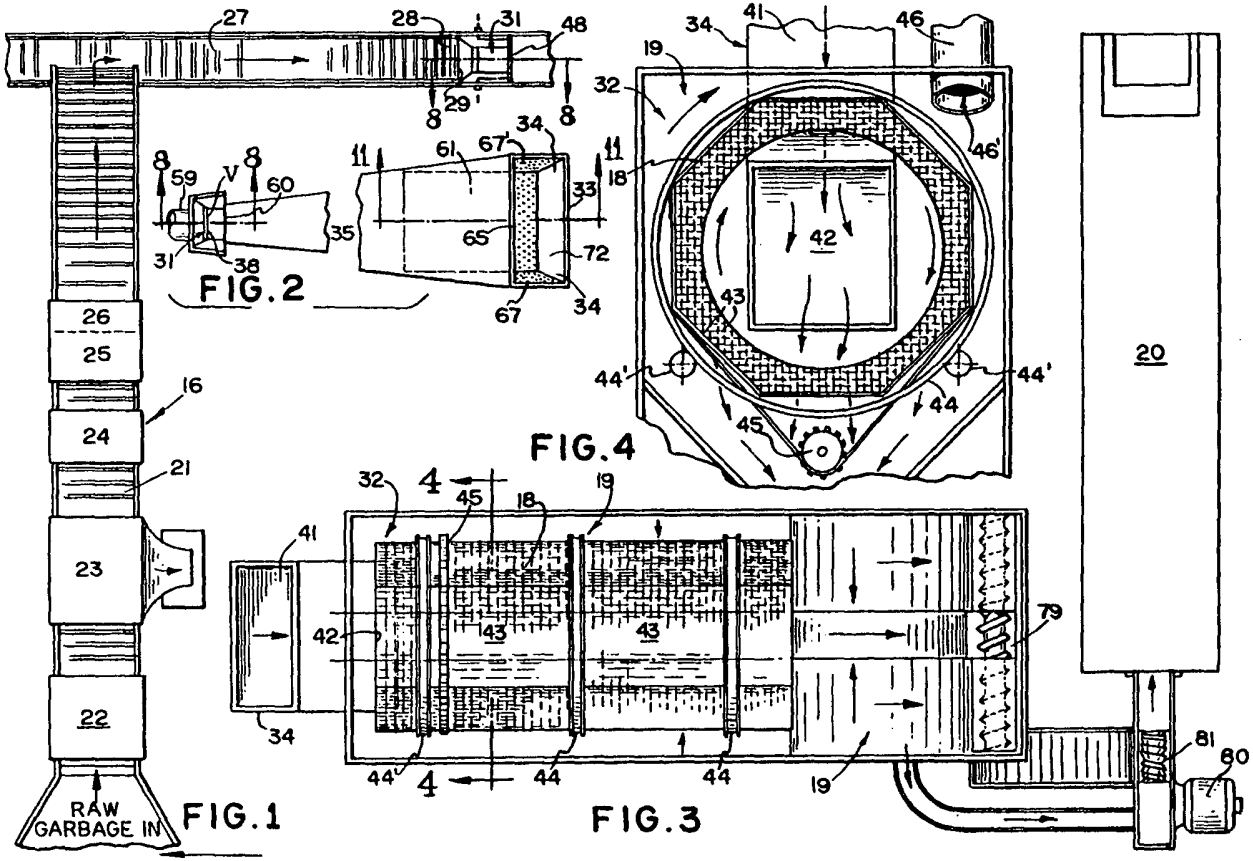

FIG. 1

FIG. 2

FIG. 3

FIG. 4

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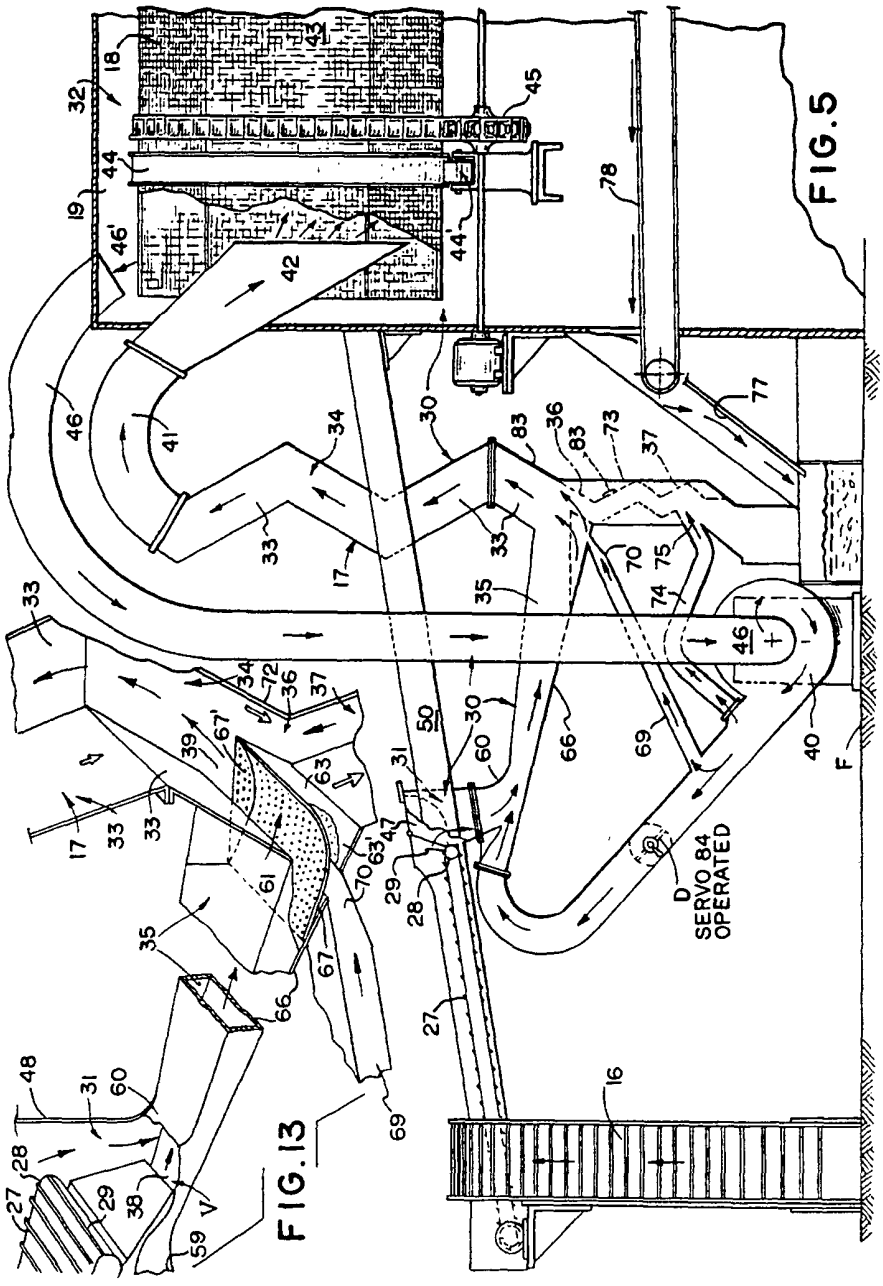

FIG. 5

FIG. 13

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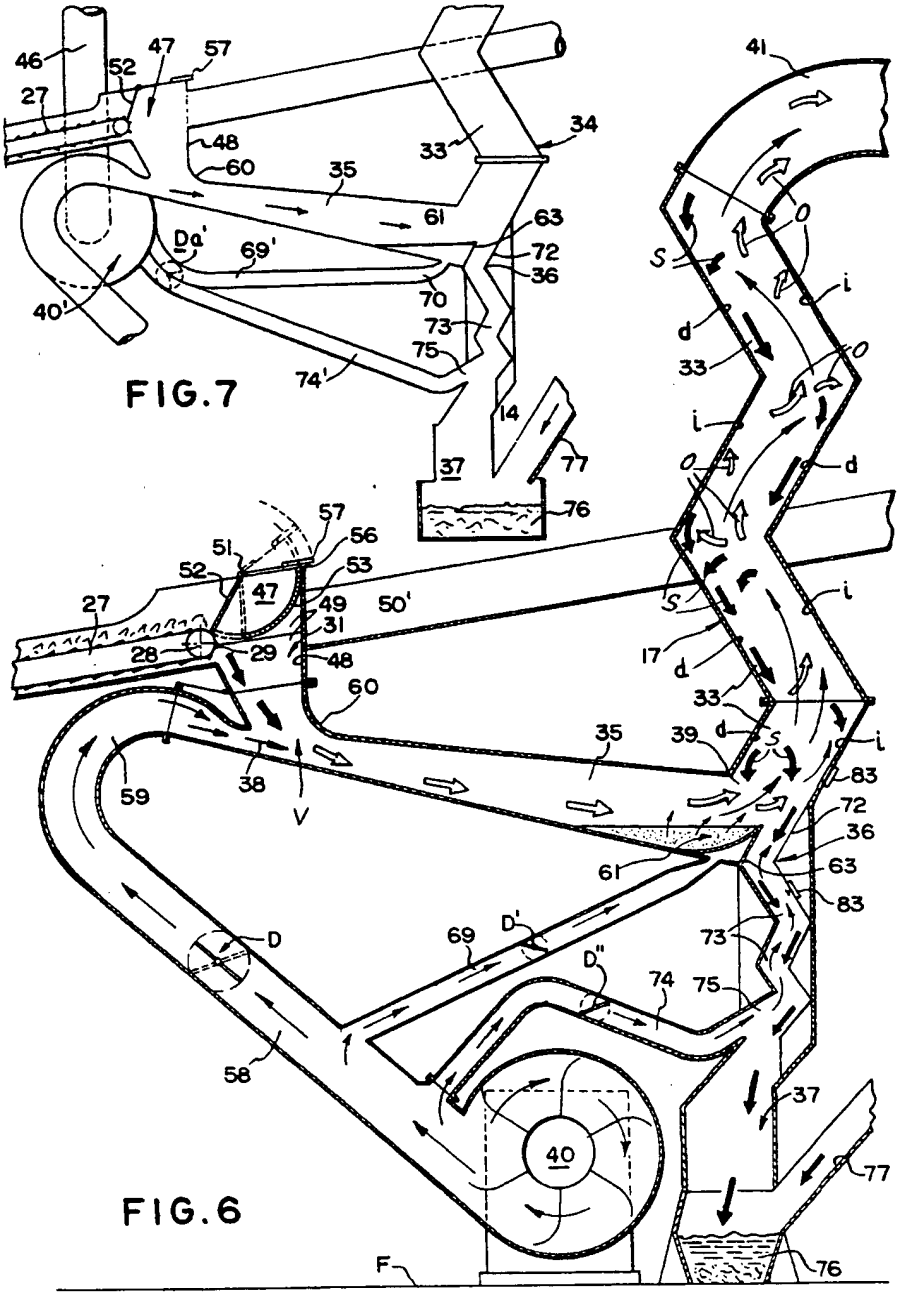

FIG.7

FIG.6

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FIG. 8

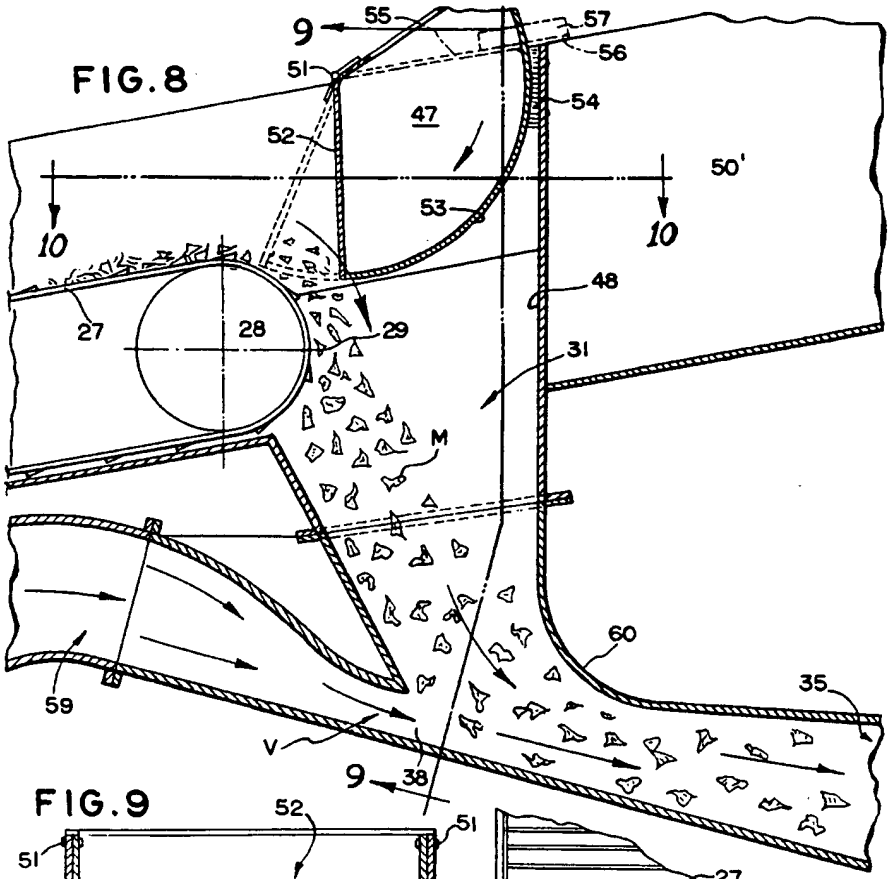


FIG. 9

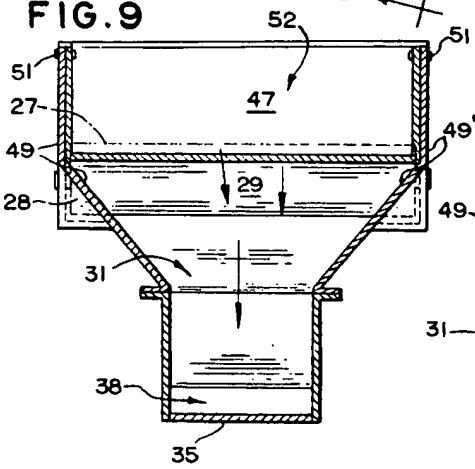
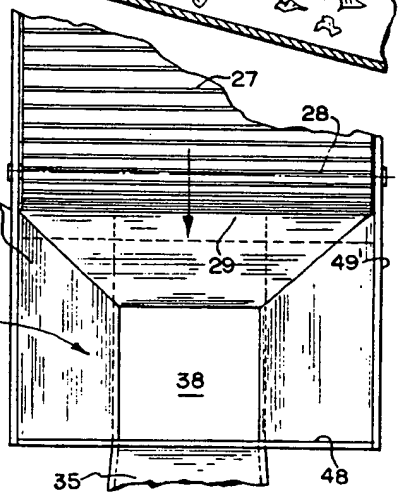


FIG. 10



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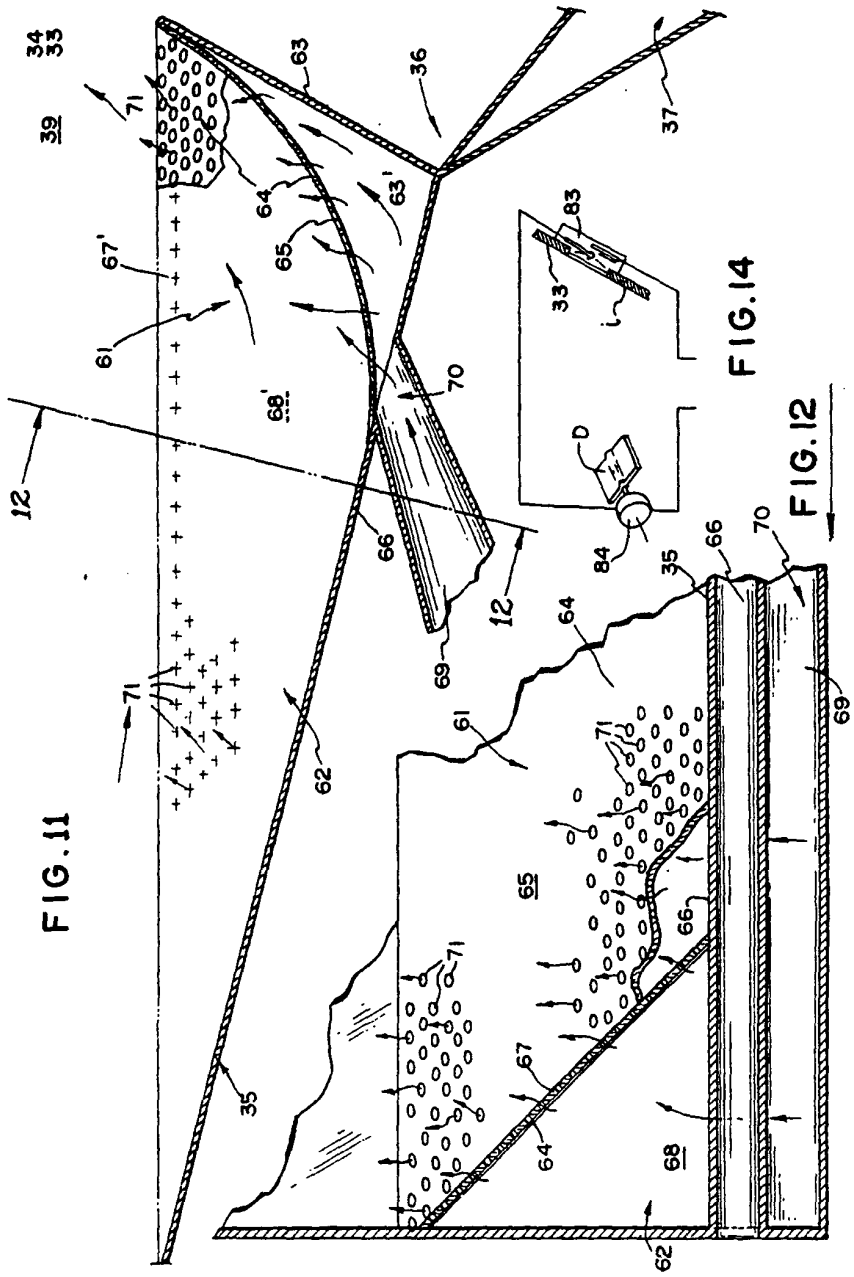
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83
33
D
84
FIG. 14
FIG. 12
FIG. 11

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